NON-CHEMICAL ALTERNATIVES FOR DRIED FRUITS AND NUTS: ISSUES AND OPPORTUNITIES

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Introduction

All or nearly all of the almonds, walnuts, pistachios, raisins, prunes, and figs produced in the United States are grown in central California. Each year this large and diverse industry yields 2.5 to nearly 3.5 million metric tons of product, worth about $2 billion (Table 1.). For most of these products, exports are a significant and vital portion of the market (Table 2). Because these high-value products are often eaten out of hand as snack food, or used in confectionary items, tolerance for the presence of live insects is zero. Consequently, postharvest insects, either field pests that may be found in the harvested product, or insects that infest product while in storage, are a serious problem during marketing.

Disinfestation of these pests is necessary for distribution of product to both domestic and foreign markets. Methyl bromide has been the treatment of choice in many cases, because the fumigant is effective, easy to use in numerous applications, and, until recently, relatively inexpensive. While replacing methyl bromide with another fumigant may be the easiest alternative, several non-chemical methods show promise as well. Identifying those applications where non-chemical methods may be used requires familiarity with the processing and storage methods as well as the marketing constraints within the industry.

Industry Overview

Harvest, dehydration, processing and storage methods within the industry vary widely. Some products are sun-dried and vulnerable to insect infestation during drying. Others are mechanically dehydrated at high temperatures, which may serve to disinfest product of field pests. The method of storage may directly affect the practicality of a treatment; dried fruits are stored stacked in bins, nuts may be in bins or silos. Cold storage to maintain quality may be used by some processors, particularly for walnuts and almonds, and will also prevent reinfestation of product by storage pests. Another factor that must be taken into account is the huge volume of product that must be treated, often within a fairly short period of time. This is of particular importance to walnut and pistachio processors, who require very rapid disinfestation treatments to meet the vital European holiday market.

Non-chemical strategies

Given the diversity within the industry, no single non-chemical treatment will be an effective replacement for methyl bromide. The following methods have been shown to have some potential for certain specific applications.

- *Radio frequency heat treatments*
  - \+ Rapid, effective, safe, does not harm product
  - – May be difficult to apply to dried fruits
- *Cold storage*
  - \+ Effective, safe, improves product quality
  - – Long exposure times, expensive if not already in use
- *Modified atmosphere*
  - \+ Effective, safe, may be applied to stacks, does not harm product
  - – Long exposure times, can require expensive retrofitting
- *Vacuum*
  - \+ Effective, safe, may be applied in cheap, flexible units
  - – Long exposure times, difficulty in treating product in bins
- *Ionizing radiation*
  - \+ Rapid treatment, does not harm dried products
  - – Does not cause immediate kill, possible problems with consumer acceptance, large capital expense may be required
- *Mating disruption*
  - \+ Effective, safe, no effect to product
  - – Single species treatment, not a disinfestation treatment
- *Microbial insecticides*
  - \+ Effective protective treatment, safe, no effect to product
  - – Single species treatment, not a disinfestation treatment, may be difficult to apply to product
- *Natural enemies*
  - \+ Useful in IPM programs, safe, effective in reducing pest populations
  - – Single species treatment, not a disinfestation treatment, not yet allowable to use in dried fruits and nuts
- *Combination treatments*
  - \+ Useful in IPM programs, safe, combines disinfestation with protective treatments
  - – Long exposure times may be necessary, may require expensive retrofitting,

Table 1. Production and Value of California Dried Fruit and Nut Crops

Year	Almonds	Walnuts	Pistachios	Raisins	Prunes	Figs	**TOTAL**
				Production (metric tons)			
1998	235,868	205,931	85,275	1,884,223	93,440	14,969	**2,519,706**
1999	377,842	256,733	55,792	1,916,881	149,685	13,698	**2,770,633**
2000	318,875	216,817	110,223	2,649,887	182,344	15,694	**3,493,840**
2001	376,482	276,691	73,028	2,009,414	122,470	11,521	**2,869,607**
2002	480,808	255,826	136,078	2,404,039	135,171	14,061	**3,425,983**
				Value (1,000 dollars)			
1998	703,590	238,350	193,640	602,330	78,692	9,801	**1,826,403**
1999	687,742	250,738	163,590	764,906	142,065	10,283	**2,019,324**
2000	666,487	296,360	245,430	484,886	154,770	11,626	**1,859,559**
2001	740,012	341,600	162,610	403,130	97,605	11,748	**1,756,705**
2002	1,049,188	304,560	333,000	442,550	120,690	13,377	**2,263,365**

Table 2. California Dried Fruits and Nuts for Export (metric tons)

Year	Almonds	Walnuts	Raisins	Prunes	Figs	**TOTAL**
1998	184,500	41,000	104,305	68,450	2,010	**400,265**
1999	197,271	41,428	83,832	66,304	2,763	**391,598**
2000	225,550	41,919	110,035	83,746	2,506	**463,756**
2001	261,319	47,099	116,019	69,653	2,399	**496,489**
2002	289,622	49,891	121,438	66,627	2,962	**530,540**

Export figures for California pistachios are not readily available.